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Effectiveness of Stress Management Strategies on Academic and Physiological Stress Among Pre-University Students

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Abstract **Background**: Academic stress is a common challenge faced by pre-university students, typically stemming from factors like high expectations, demanding coursework and peer competition. This type of stress can have detrimental effects on both mental health and academic performance, making it essential to find effective methods for managing stress. **Aim of the Study:** The study aimed to evaluate the effectiveness of stress management strategies on academic stress and biochemical marker among pre university students in selected colleges. **Methods:** The study adopted a quasi-experimental design, conducted at the Government Pre-University College in Bidadi, Karnataka. The study involved 200 students, divided into an experimental group (100) and a control group (100), selected through non-probability convenient sampling. The experimental group underwent an eight-week stress management program focused on enhancing psychological resilience, while the control group followed their usual academic routine. Academic stress levels were evaluated using the Perceived Stress Scale (PSS) and the Academic Stress Scale (ASS), while salivary cortisol levels were measured as a biological indicator. Data was collected at the start of the study, after four weeks and after eight weeks. **Results:** The study revealed significant reductions in both academic stress and perceived stress ($p<0.001$) in the experimental group compared to the control group. Furthermore, post-test cortisol levels were markedly lower in the experimental group ($t = 3.665$, $p<0.001$), demonstrating the effectiveness of the intervention. **Conclusion:** The findings suggest that stress management strategies are highly effective in reducing academic stress and cortisol levels among pre-university students.

Key Words Academic Stress, Stress Management, University Students, Biochemical Markers

INTRODUCTION

Academic stress is a common challenge faced by pre-university students, typically stemming from factors like high expectations, demanding coursework and peer competition [1]. Understanding the link between psychological stress and physiological reactions is key to comprehending how stress affects students. Biochemical markers, particularly cortisol, are commonly used to assess the body's response to stress. Elevated cortisol levels are linked to both acute and chronic stress and if left unmanaged, they can lead to a range of physiological issues [2]. Chronic stress, in particular, is associated with negative impacts on mental health, impairing cognitive functions and overall academic performance [3].

To mitigate the adverse effects of academic stress, effective management strategies are essential. These strategies involve various interventions designed to improve students' coping abilities and enhance their resilience. Cognitive-behavioral approaches, mindfulness practices and biofeedback techniques have been identified as effective methods for reducing perceived stress levels among students [4]. Training programs focused on problem-solving and adaptive coping mechanisms have shown significant improvements in stress management [5]. Moreover, a meta-analysis of stress management programs suggests that structured interventions can lead to substantial reductions in stress-related symptoms, promoting better mental health and academic success [6].

Biofeedback is a method that enables individuals to become aware of and control their physiological processes, has emerged as a promising method for managing stress among students. It enables students to recognize and regulate

their physiological responses to stress through self-regulation strategies [4]. Research has demonstrated that biofeedback interventions can significantly reduce anxiety and stress levels, leading to improved academic performance and overall well-being [7]. Furthermore, integrating social support systems into stress management interventions has been shown to enhance resilience, providing students with the necessary tools to navigate academic pressures [8].

Stress management strategies is crucial in addressing academic stress and its biochemical markers among pre-university students. As the challenges posed by stress become more widely recognized, it is imperative to adopt multifaceted approaches that incorporate psychological, behavioral and physiological elements, creating a supportive environment that fosters academic success. Existing research often omits the combined assessment of psychological and biological stress indicators like cortisol. Additionally, there is limited evidence on the long-term effectiveness of stress management interventions in pre-university contexts. This gap highlights the need for integrated, age-appropriate strategies to address both academic and physiological stress holistically.

Aim of the Study

The study aimed to evaluate the effectiveness of stress management strategies on academic and physiological stress among pre-university students.

METHODS

Study Design and Setting

This study employed a quasi-experimental design and was conducted at Government Pre-University College, Bidadi, in the Ramanagara District of Karnataka.

Participants and Sampling

A total of 200 pre-university students participated in the study. Of these, 100 were assigned to the experimental group and 100 to the control group, selected through non-probability convenience sampling. Students who provided written informed consent were included in the study. Those with irregular school attendance, unwillingness to participate or critical illness preventing participation were excluded.

Data Collection Procedure

Academic stress levels were assessed using the Perceived Stress Scale and the Academic Stress Scale, both validated tools. Stress was measured through psychological assessments and cortisol levels as a biochemical marker. The experimental group received an intervention for eight weeks, with sessions held six days a week for 30 minutes daily, while the control group continued with their regular academic activities. Both groups were reassessed at the end of the fourth and eighth weeks using the same stress assessment tools and cortisol measurements.

Ethical Clearance

The institutional ethics committee granted ethical approval to the study. Informed consent was given by all participants, where confidentiality was assured and the participant had a choice to discontinue the study at any time. The research followed ethical standards to protect the safety and well-being of all involved.

Statistical Analysis

The data was compiled into a master data sheet and analyzed using descriptive and inferential statistics. Normality of the data distribution was assessed using the Shapiro-Wilk test. Differences between groups were evaluated with a two-way ANOVA and Chi-square tests. All statistical analyses were conducted using SigmaPlot version 14.0.

RESULT

Demographic Variables

Table 1 presents the demographic characteristics of the sample revealed that male participants constituted 48% of the Control group and 34% of the Experimental group, while females represented 52% and 66%, respectively. A majority of the participants came from nuclear families, accounting for 90% in the Control group and 80% in the Experimental group. Analysis of paternal education showed that the majority had attained primary education, with 73% in the Control group and 69% in the Experimental group. With respect to paternal occupation, 73% of fathers in the Control group were engaged in farming, in contrast to 44% in the Experimental group. Regarding family income, 84% of the Control group reported earnings above 20,000 rupees, compared to 61% in the Experimental group. The religious affiliation was predominantly Hindu for both groups, each comprising 95%. The current place of residence was similarly distributed, with 90% in the Control group and 89% in the Experimental group residing in the same locality. he chi-square tests reveal significant differences only in father's occupation ($p<0.001$) and family income ($p<0.001$), with gender showing a slight imbalance ($p = 0.062$), while other factors suggest homogeneity between the groups.

Academic Stress and Perceived Stress

The study compared Academic Stress (AS) and Perceived Stress (PS) across control and experimental groups. For AS, the control group showed a slight decrease from pre-test (20.0) to post-test (19.4), whereas the experimental group showed a significant decrease from pre-test (19.8) to post-test (14.2). Similarly, for PS, the control group decreased from 20.2 to 19.1, while the experimental group decreased from 20.6 to 14.6. Statistical analyses revealed a significant interaction between groups and tests ($F = 406.380$, $p<0.001$ for AS; $F = 301.753$, $p<0.001$ for PS) (Table 2).

Salivary Cortisol Levels

The comparison of salivary cortisol levels between the control and experimental groups showed that the experimental group had lower post-test cortisol levels ($M = 15.69$) compared to the control group ($M = 17.27$). There was no significant difference in pre-test cortisol levels between the control ($M = 17.31$) and experimental ($M = 16.87$) groups ($t = 0.152$, $p = 0.879$). However, a

Table 1: Demographic Data of the Pre University Students

S. No.	Variable	Category	Control (N = 100)	Experimental (N = 100)	Chi-Square
1	Gender	Male	48	34	$\chi^2 = 3.493$ p = 0.062
		Female	52	66	
2	Family type	Nuclear	90	80	$\chi^2 = 3.176$ p = 0.075
		Joint	10	20	
3	Father education	No formal education	12	15	$\chi^2 = 0.478$ p = 0.787
		Primary	73	69	
		Secondary	15	16	
4	Mother education	No formal education	12	13	$\chi^2 = 0.644$ p = 0.725
		Primary	71	66	
		Secondary	17	21	
5	Father's occupation	Farmer	73	44	$\chi^2 = 29.579$ p<0.001
		Labour	19	27	
		Business	0	21	
		Government Servant	8	8	
6	Mother's occupation	House hold work	45	33	$\chi^2 = 3.185$ p = 0.203
		Farmer	38	44	
		Labour	17	23	
7	Family income (rupees)	<20000	0	16	$\chi^2 = 20.905$ p<0.001
		20000	16	23	
		>20000	84	61	
8	Religion	Hindu	95	95	$\chi^2 = 0.105$ p = 0.746
		Others	5	5	
9	Present stay	Family	90	89	$\chi^2 = 0$ p = 1.0
		Hostel	10	11	

Table 2: Comparison on Academic Stress (AS) and Perceived Stress (PS)

S. No.	Groups	Test	Academic Stress	Perceived Stress
1	Control	Pre test	20.0±0.5	20.2±0.3
	Control	Post test	19.4±0.5	19.1±0.3
	Experimental	Pre test	19.8±0.4	20.6±0.4
	Experimental	Post test	14.2±0.3	14.6±0.3
2	Control and Experimental group		F = 21.607 p<0.001	F = 18.888 p<0.001
	Pre-test and Post-test		F = 634.457 p<0.001	F = 628.789 p<0.001
	Groups X test		F = 406.380 p<0.001	F = 301.753 p<0.001

Table 3: Comparison on Salivary Cortisol Among the Participants

S. No.	Groups	Test	Salivary cortisol
1	Control group	Pre test	17.31±0.23
	Control group	Post test	17.27±0.23
	Experimental group	Pre test	16.87±0.24
	Experimental group	Post test	15.69±0.21
2	Control and Experimental group		F = 3.741 p = 0.055
	Pre-Test and Post-test		F = 378.092 p<0.001
	Groups×Test		F = 117.802 p<0.001

significant difference was observed in post-test cortisol levels (t = 3.665, p<0.001), indicating a notable reduction in cortisol levels in the experimental group (Table 3).

DISCUSSION

The study finding indicates that the experimental group experienced a substantial decrease in academic stress, contrasted with the minor reduction observed in the control group (F = 406.380, p<0.001). This aligns with research demonstrating that resilience training effectively mitigates academic stress, highlighting the importance of psychological frameworks that foster resilience [9,10]. Similarly, evidence shows that resilience-focused interventions can have enduring effects on reducing academic stress, contributing to overall student well-being [11]. Further support suggests that targeted interventions can significantly alleviate stress among university students, reinforcing the experimental group's outcomes reported in your analysis [12].

The reduction of perceived stress in the experimental group, while the control group showed a mere decline, further emphasizes the effectiveness of the intervention (F = 301.753, p<0.001). Research corroborates these findings by demonstrating that psychological capital serves as an adaptive resource that mitigates academic

distress [13]. A study supports the notion that cognitive-behavioral interventions can make meaningful impacts on stress perception among college students [14]. Additionally, findings indicate the mediating role of resilience in reducing academic-related anxiety and stress, aligning with the significant changes observed in perceived stress [15].

In relation to salivary cortisol levels, the analysis revealed no significant difference in pre-test cortisol levels between groups ($t = 0.152$, $p = 0.879$), while the post-test revealed a significant reduction in the experimental group ($t = 3.665$, $p<0.001$). This finding is consistent with earlier research suggesting that practices aimed at managing stress-such as mindfulness and psychological interventions-can effectively lower salivary cortisol [16,17]. The overall significant within-group changes observed for all measured variables ($p<0.001$) support the premise that behavioral and psychological interventions can fundamentally shift stress dynamics among students. This is consistent with findings indicating that school-based interventions can effectively manage adolescent psychological stress, despite varying levels of effectiveness reported in previous studies [18,19].

This study underscores the need for academic institutions to integrate stress management programs into their curricula. Policy recommendations include offering workshops on coping skills, providing counseling resources and creating a supportive learning environment to improve student well-being and academic performance.

CONCLUSIONS

The study concluded that the experimental intervention significantly reduced both academic stress and perceived stress in the experimental group, with notable differences between pre-test and post-test results. Additionally, the experimental group exhibited a significant reduction in salivary cortisol levels post-test, indicating a physiological reduction in stress. In contrast, the control group showed only minimal changes in stress levels and cortisol. These findings suggest that the intervention was effective in managing both psychological and physiological stress, highlighting its potential as a stress-reduction strategy.

Limitations

The study's limitations include a small sample size that may not represent the broader pre-university student population, reliance on self-reported measures which could lead to biases and the short duration of the intervention, which may not capture long-term effects on stress management.

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